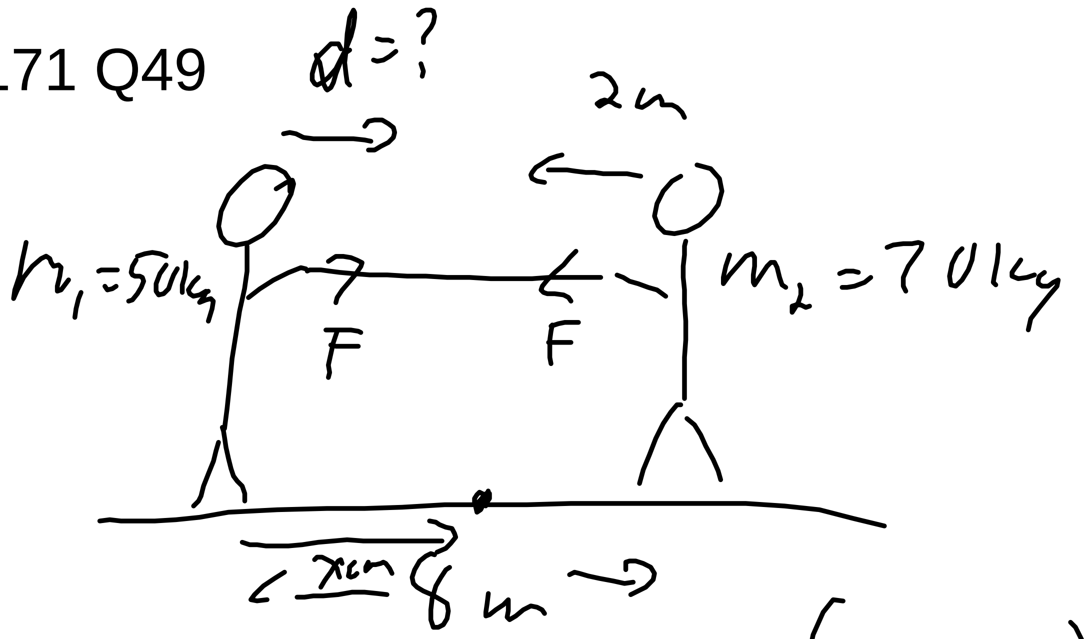
P171 Q49



a) $x_1 m_1 + x_2 m_2 = (m_1 + m_2) x_{cm}$

$0 + 8m(70kg) = 120kg\, x_{cm}$

$x_{cm} = 4.7 m$

b) Conservation of P

$m_1 v_1 = m_2 v_2$

$\frac{m_1 d_1}{t} = -\frac{m_2 d_2}{t}$

$d_1 = -\frac{70kg}{50kg} 2m = 2.8 m$

d) collide at cm

$8m - 4.7m = \boxed{3.3m}$

Statics

Torque, $\tau = F \times r$ (F: Force; ×: cross product; r: radial distance to reference point or rotation point)

$$\boxed{\tau = Fr\sin\theta}$$

Translational equilibrium

$$\Sigma F = 0$$

Rotational equilibrium

$$\Sigma \tau = 0 \qquad \tau_c = \tau_{cc}$$

(τ_c: clockwise; τ_{cc}: counter-clockwise)

Statics

$\Sigma F = 0 \quad \Sigma \tau = 0$

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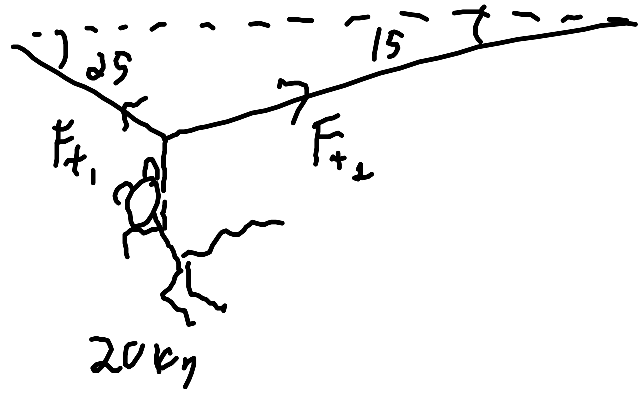
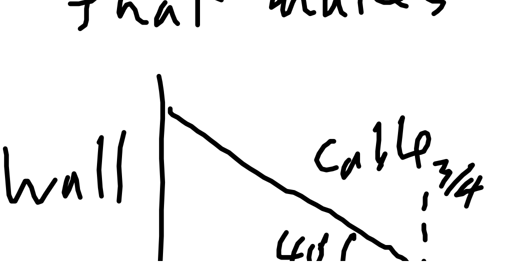
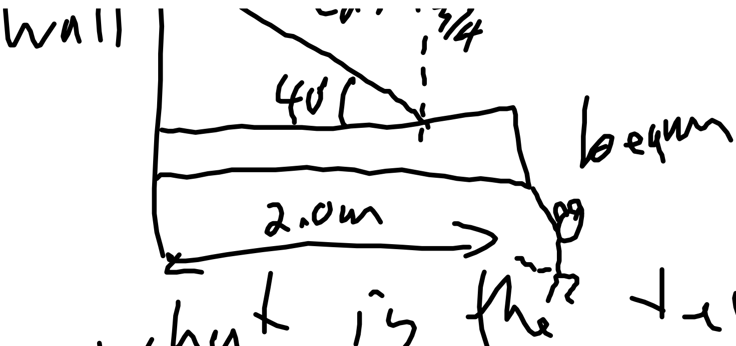
Sample questions

1, a) 20.0kg monkey is hanging from a vine what is the tension on each side of the vine if



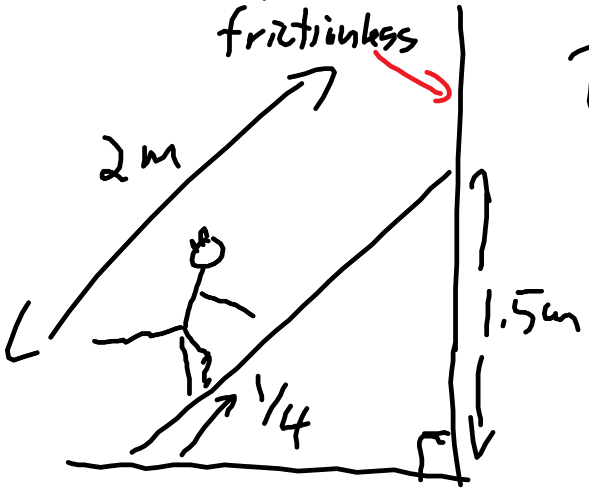
b) A 50kg beam is 20m long and has a cable supporting it 3/4 of way that makes a 40.0 angle.



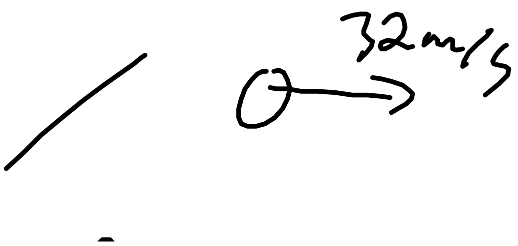


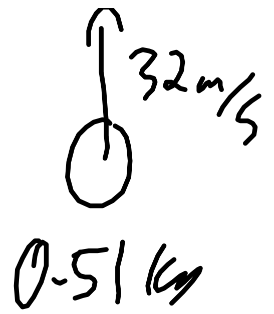
- what is the tension in the cable?
- If the monkey hangs from the end, what is the tension? and force on the wall?

c)

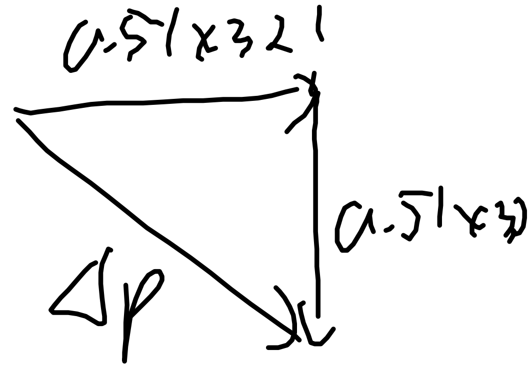


The 20kg monkey climbs a 5kg ~~ladder~~ ladder resting on a frictionless wall. What is the frictional force of the ground on the ladder?? when it is 1/4 of the way up?





$\Delta p = p_f - p_i$



Q7

$W = \Delta E_{k_1} + \Delta E_{k_2}$

$W = \frac{1}{2} 0.4 (1.2)^2 + \frac{1}{2} 0.8 (0.6)^2$

$p_1 \sin 28^\circ = p_2 \sin 21^\circ$

$\frac{GMm}{r} = \frac{1}{2} m v^2 \quad v \propto \frac{1}{\sqrt{r}}$

$\frac{V_1}{V_r} = \frac{1/\sqrt{r}}{1/\sqrt{2r}} = \sqrt{2}$

$V_1 : V_2$

$$\frac{1}{\sqrt{r}} : \frac{1}{\sqrt{2r}}$$

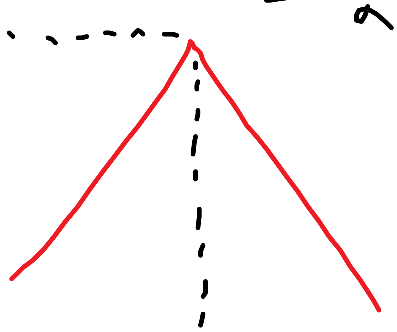
$$\frac{1}{\sqrt{r}} : \frac{1}{\sqrt{2}\,\sqrt{r}}$$

$$1 : \frac{1}{\sqrt{2}}$$

$$1 : \frac{\sqrt{2}}{2}$$

Q10 Area $= \frac{1}{2}$ base × height

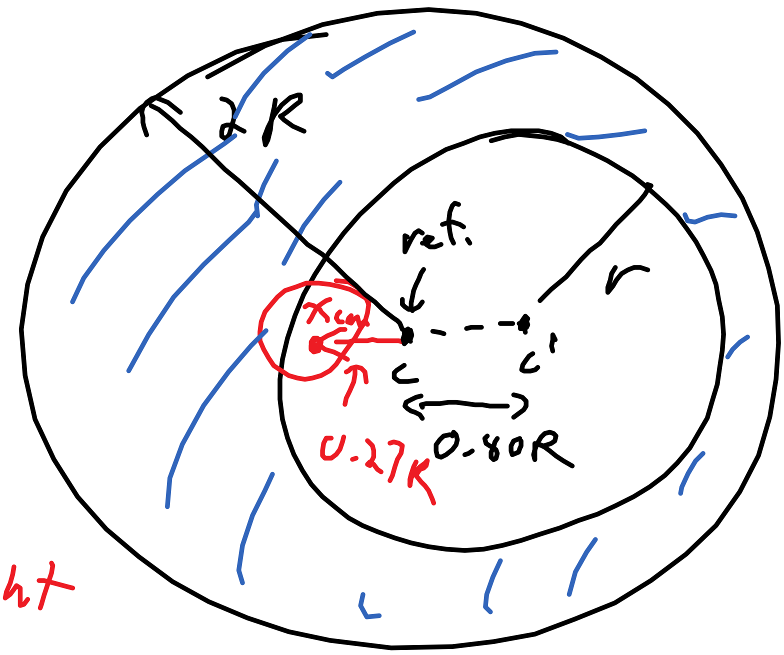
$= \frac{1}{2}\, 0.2s\,(10N) = \underline{1N}$



$$\tau = F_t\, r \sin\theta$$

P171

Q47



$\rho = \frac{M}{V}$

$M = \rho V$

density, height

$M = \rho h \pi r^2$

↑ A

$M \propto r^2$

$m_1 x_1 + m_2 x_2 = (m_1 + m_2) x_{cm}$

$A(2R)^2(0) - A(R)^2(0.80R) = (A(2R)^2 - AR^2)\, x_{cm}$

removed

$-0.8R = (4-1)\, x_{cm}$

$x_{cm} = \frac{-0.8}{3} R = \boxed{-0.267R}$

Q45 $V = \frac{4}{3}\pi r^3$

A

$M = \rho V = \rho \frac{4\pi}{3} r^3$

density

$m_1 x_1 + m_2 x_2 + m_3 x_3 = (m_1 + m_2 + m_3) x_{cm}$

$A r_0^3 \, 0 + A(2r_0)^3 (3r_0) + A(3r_0)^3 (8r_0) =$

$A(r_0^3 + (2r_0)^3 + (3r_0)^3) x_{cm}$

Statics

Torque $\tau = F \times r$

$\tau = F r \sin\theta$

translational equilibrium

$\Sigma F = 0$

rotational equilibrium

$\Sigma \tau = 0 \quad \tau_c = \tau_{cc}$

statics

$\Sigma F = 0 \quad \Sigma \tau = 0$